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## Changing Coastal Landscapes : Shore displacement and the strategies for defence and subsistence at the medieval castle of Raseborg

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# Changing Coastal Landscapes

Shore displacement and the strategies for defence and subsistence at the medieval castle of Raseborg

**ABSTRACT:** Recent archaeological research around the medieval Castle of Raseborg has shown that in the Middle Ages the most prominent changes in the surroundings of the castle, both natural and man-made, are related to the littoral landscape of the site. Archaeological data offers new information on post-glacial shore displacement in the region, and suggests that during the first half of the 16th century the shore level around the castle was considerably lower than expected. Shore displacement also affected the castle's strategies for defence and subsistence.

**KEY WORDS:** Middle ages, Raseborg castle, landscape, post-glacial shore displacement, defence, warfare, subsistence, coastal resources.

## INTRODUCTION

The ruins of Raseborg Castle are situated in Snappertuna, western Uusimaa (*Nyland* in Swedish), some 12 kilometres southwest from the town of Karjaa (*Karis* in Swedish) (Fig. 1). Today the castle site lies about 3 kilometres from the coastline, by the river called Raseborgsån or Kungsån.

The castle has a long history of archaeological and historical study, starting from the 1890s. In 2008 the research project *Raseborg Through the Ages* initiated a new period of systematic archaeological research on the castle site. The central goal of the project was to broaden the research scope from the main castle to its surroundings. The project included archival research, archaeological surveying and excavations at several sites in the vicinity of the

castle, and produced a novel body of material for future research (Haggrén, Jansson, Holappa & Knuutinen 2009; Haggrén & Jansson 2012; Haggren 2013). The archaeological field work in Raseborg continued in 2014 with new excavations in and around the castle (Haggrén 2014b; Knuutinen 2014).

The focus of this article is on regional post-glacial shore displacement and its impact on the medieval landscape as well as the way it was organised. First, the complexity of shore displacement at the site is discussed in order to better understand its role in the formation of the landscape. The second part of the article focuses on the two central functions of the castle, defence and subsistence, which are landscape bound and were affected by the changes caused by shore displacement.



Figure 1. The Raseborg Castle site is located on the southern coast of Finland. The map also presents the location of Hanko, Älgö in Tammisaari and Orslandet in Inkoo. 1 – Turku, 2 – Raseborg, 3 – Helsinki, 4 – Vyborg. Map: Maija Holappa.

### Raseborg castle

The historical sources concerning the castle are sparse before the reign of King Gustav Vasa. The present understanding is that Raseborg was founded in the latter part of the 1370s by Bo Jonsson (Grip), the Lord High Steward of the Swedish realm (Drake 1991: 91). The first mention of Raseborg is in a charter signed at Raseborg by Tord Bonde on 8 September 1378 (Nationel Arkiv Databas, SDHK 11301/ RA 0101).

The castle acted as the administrative centre of the Castle Province of Raseborg (today's western Uusimaa) until the mid-16th century. It was enfeoffed to many of the most prominent men of the Swedish realm, perhaps the most important being King Karl Knutson (Bonde), who held the castle as his personal fief during the mid-15th century (e.g. Haggrén 2013). Besides administrative and residential functions, Raseborg undoubtedly had military importance as well. However, the only strong evidence for the castle in a military conflict is a battle between Swedes and Danes, presumably in 1523, in which the castle was destroyed (Hartman 1986: 71; Rask 1991: 71; Haggrén 2014a: 22; Terävä 2015:

110). The castle was also an important agricultural centre. The historical sources indicate that there was a landed estate under the control of the castle at least since the beginning of the 16th century, but it is probable that the large agricultural estates of the castle were organised under a manor or landed estate even earlier.

The importance of the castle was at its highest during the 15th century and the beginning of the 16th century, but after the 1530s the castle rapidly lost both its political and military relevance. In 1550, a new administrative centre was founded in Helsinki, and Raseborg accordingly lost its administrative role. As recent studies by Georg Haggrén have shown, Raseborg was not abandoned immediately, but the castle continued to be used in some capacity until 1558 when part of the castle collapsed, after which it fell into disuse (Haggrén 2014a: 24–5, Fig. 2).

Antiquarian interest towards the castle ruins grew during the first half of the 19th century, and since the 1890s the castle site has been a subject of archaeological and historical research. Most of the research has concentrated on the castle itself, but excavations have also been done in the surrounding

areas. Unfortunately, the main body of the studies remain unpublished, excluding several publications by Knut Drake, mainly concerning the construction history of the castle (e.g. Drake 1983; 1988; 1991).

#### A landscape approach to the history of Raseborg

Raseborg represents a fruitful opportunity for landscape archaeology for many reasons, not least because it is the only still-standing medieval royal castle in mainland Finland that is not surrounded by modern urban settlement. Historical sources tell very little of the early phases of the castle and they are not very informative about the development of infrastructure supporting everyday life in and around the castle. The castle accounts offer rich information about life in Raseborg from 1540 onwards, but little information is available about the surroundings of the castle and how they were organised. However, the ruins of the castle and its surroundings have been depicted in several maps dating from the 17th and 18th century.

The unbuilt rural landscape in Raseborg offers a multitude of opportunities for landscape studies (e.g. Knuutinen 2012; Haggrén 2013). On the other hand, the seemingly unchanged landscape might induce the researcher to assume that the topographical features and other phenomena of the modern landscape somehow represent the "original" or "medieval" landscape. This can lead to misinterpretations when reconstructing and interpreting medieval land use and the spatial organisation of the castle's surroundings (on the subject, see Uotila 1998: 127–8; Knuutinen 2010; 2012). Therefore, some aspects of the history of the landscape should be stressed.

Raseborg is situated in a low-lying coastal region where the single most important factor in the natural landscape has been shore displacement caused by post-glacial land uplift (Fig. 2). The topographical setting of the landscape has also been affected by intentional construction and landscaping, both in the Middle Ages and in modern times. Because of lacking or insufficient documentation on the modern landscaping, the dating of specific features at Raseborg is very difficult. There are uncertainties concerning, for example, the authenticity of

the moats around the castle. On the other hand, recent excavations in the vicinity of the castle have shown that even large-scale constructions carried out during the Middle Ages have completely dissolved into the modern landscape and thus are invisible to the researcher (e.g. Haggrén & Jansson 2012; Knuutinen 2012; 2014).

Excavations also show that even in the Middle Ages the most prominent changes in the surroundings of the castle, both natural and man-made, are related to the littoral landscape of the site. Changes in the natural landscape have promoted processes wherein the environs of the castle were reorganised. Therefore, knowledge of the history of the region's littoral environment is essential.

#### SHORE DISPLACEMENT IN THE RASEBORG REGION

According to the isobase curves of Fennoscandia presented by Ekman (1996), the mean rate of relative land uplift in the Raseborg region is 3.0 mm per year.<sup>1</sup> Similar curves for present relative land uplift have also been presented by Eronen et al. (2001), Pässe & Andersson (2005: 261) and Vestøl (2006). Using the mean value of *current* land uplift for modelling shore levels over a period of hundreds or thousands of years can be problematic, since the models are based on an assumption that the rate has been linear through the ages. In line with the majority of the geologically orientated research on the Baltic shore displacement, Ekman's research (1996: 163–4) implies a linear land uplift since 5000 BC throughout the entire Fennoscandia region. However, this linearity has been repeatedly challenged, mostly by archaeologists, in Finland and Sweden (e.g. Åse 1969; 1970; Ambrosiani 1981; Ödman 1987: 45–74; Hiekkanen 1988: 60–4; Wahlberg 1994; Uotila 1998: 84–6, 111, 128, 133; 2000).

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<sup>1</sup> Relative land uplift refers to the land uplift relative to the mean sea level. In the curves presented by Ekman a sea level rise of 1.2 mm/year has been taken into account (Ekman 1996: 163. See also Pässe & Andersson 2005: 261).



Figure 2. The Castle of Raseborg from the southwest. The western part of the castle rests on a high rocky outcrop. The grass field at the foot of the outcrop lies approximately 1.0 to 1.5 meters above the present-day sea level. Photo: Tarja Knuutinen.

Considering the location and date of the Raseborg Castle site, a regionally and temporally more precise perspective on land uplift is presented in a study by Miettinen (2011), where the rate of shore displacement is based on the isolation time of selected lake basins in five areas in western Uusimaa. Two of these, Älgö in Tammisaari (Ekenäs in Swedish) and Orslandet in Inkoo (Ingå in Swedish) are particularly interesting since the castle site is situated between the two locations. According to Miettinen (2011: 81), the shore level at Orslandet, some 15 kilometres southeast from the castle site, has been 2 m a.s.l. in AD 1000 and 1 m a.s.l. in AD 1500. In the Älgö area, circa 20 kilometres southwest from the castle site, the shore levels have been 3 m a.s.l. in AD 1000 and 1.5 m a.s.l. in AD 1500.<sup>2</sup> The results from Älgö fit perfectly in the frame of 3.0 mm yearly land uplift, but as the results from Orslandet show, the rate has been significantly different only some 30 kilometres to the east.

Small fluctuation in the land uplift rate is less problematic when modelling prehistoric shores, since the longer time span and growing distance from the modern seashore gives more flexibility in the interpretation of the models. When modelling

shore displacement on a relatively recent site located in today's coastal region, the uncertainty and possible inaccuracy of the models becomes more problematic. Because of the short time span, the intervals between the modelled periods become shorter and the differences between the shore levels grow smaller across the studied period.

Another issue affecting the reliability of the shore level models in a low-lying landscape is the normal annual fluctuation in sea level. As the series of sea level height data from Finnish south coast tide gauges from 1887 to the present show, the annual fluctuation can be considerable. At the tide gauge stations closest to Raseborg, the maximum fluctuation during the measuring period has been +133 cm (Hanko) and +151 cm (Helsinki), the minimum respectively -79 cm and -93 cm (Finnish Meteorological Institute, <http://ilmatieteenlaitos.fi/vedenkorkeusennatukset-suomen-rannikolla>).

The fluctuation data from the last 120 years cannot be applied straightforward to medieval times, but it gives an idea of the magnitude of the phenomenon. Even if the normal annual fluctuations were smaller than the extremes presented above, the shore level models based on the relative land uplift rate can present only the average height of the shore line; in a low-lying landscape a vast area above this average height would have been affected by temporary rises in sea level (see also Wahlberg 1994).

<sup>2</sup> According to Miettinen (2011: 84) the margin of error in isolation studies is approximately 0.5 m.



The problems discussed above are pertinent to Raseborg, where the lowest parts of the castle site are located only 0.5 m a.s.l., and even small changes in water level can cause considerable changes in the landscape. On the other hand, seemingly small changes in the topographical conditions can alter the models of the withdrawing shoreline. For example, to create a romantic setting for the castle ruins, the topographical conditions in the castle area were purposely altered during the period of early restorations, from the 1890s to the 1950s. During that time, the easily flooding riverbank on the southern and western side of the castle as well as parts of the castle's low-lying surroundings were filled. The river bank was raised altogether some 0.6 to 1.0 m, thus the impact on the local topography has been significant (Knuutinen 2010, Fig. 3).

#### Shore displacement model of the Raseborg region

The shore displacement model of the Raseborg region presented in this article is based on the digital elevation model of the Finnish National Survey (2 metres grid, N2000-system). The shore levels presented are based on the linear rate of shore displacement at 3.0 mm/year, respectively 2.1 m a.s.l. in the

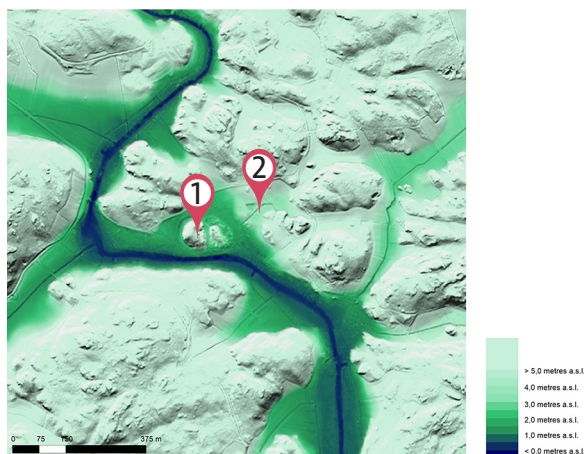


Figure 3. The present-day topography of the castle site has been altered by medieval and modern landscaping. The lowest parts of the castle site are still just above the present sea level. 1 – Raseborg castle, 2 – Slottsmalmen. Map: Tarja Knuutinen.

14th century, and 1.5 m a.s.l. in the 16th century (Fig. 4). Furthermore, shore levels based on new archaeological data are suggested for the 14th and 16th centuries. For the area closest to the castle, a shore line reconstruction for the time prior to the heavy medieval landscaping of the shore zone is presented, based on the archaeological data from the site (Fig. 5).

The new shore displacement models show the change that took place in the regional sea level height during the period from the 14th to the 16th century, and thus differ from the previous, more static models published by Alopaeus (1984: 86) and Drake (1991: 90, 92). The model given by Alopaeus presents a shore level reconstruction only for the 1550s, and covers only the closest surroundings of the castle. The presented shore level is based on the shore displacement rate of 3.6 mm per year adopted from calculations by Erkki Kääriäinen (1963; see also Uotila 1998: 127). Exact height information has not been given but the suggested shore level seems to follow the 2.0 m a.s.l. contour line. The relatively rough model published by Drake covers a considerably larger area, including the whole lower course of the Raseborgsån River together with the inlet stretching northwards on the western side of the river. Drake's model presents the shore level only for the 14th century, with no reference to the height of the shore level. However, in the same publication, Henry Rask refers to a shore level height of 2.5 m a.s.l. in the end of the 12th century (Rask 1991: 35).

Kari Uotila (1998: 127–8) has criticised the previous models for not considering the landscaping and filling made in the vicinity of the castle during medieval and modern times. The poor documentation of the early excavations and restorations has made the evolution of the landscape difficult to trace. Nevertheless, some observations can be presented, based on excavations done during 2008–2009 and in 2014 (Fig. 5).

The excavations conducted in 2008–2009 and 2014 at the so-called Slottsmalmen, located 200 metres east from the main castle (Fig. 5), have revealed layers and structures that shed light on the environmental conditions and medieval usage of the area.



Figure 4. The shore level reconstructions of the Raseborg region for the 14th and 16th centuries. Map: Tarja Knuutinen and Maija Holappa.

During the excavations in 2008 and 2009 a large earthen embankment was found in the area, and underneath it a thick layer of decaying woodwork refuse. A similar phenomenon was observed also during excavations in the western part of Slottsmalmen area in 2014 (Knuutinen et al. 2008; 2009; Knuutinen 2014).

The embankment, approximately 60 m long and at its highest point 1.2 m high, stretches over the whole Slottsmalmen area in an east-west direc-

tion. The embankment was built in several phases. The original, approximately 12-metres-wide core was constructed out of clay and sand. At some point the core was supported and heightened by dumping waste on its shore side, after which the total width of the embankment was approximately 26 metres.

The artefacts found from the layers of the embankment date the structure to the late 14th–mid-15th century, and the preliminary results of the 14C datings from the embankment suggest that



construction was initiated even earlier, in the mid-14th century.<sup>3</sup> The good preservation of the organic layer underneath the embankment suggests that it originally stratified in shallow water, representing the last phase of shoreline before the construction of the embankment, located on a level of 1.8 to 2.4 m a.s.l. (Knuutinen & al. 2008; 2009). These results place the highest point of the 14th-century shore on a level of 2.4 to 2.5 m a.s.l.

The remains of a building excavated at the western part of Slottsmalmen in 2014 offer more information for controlling the model. The excavated part of the building consisted of the stone footing of one wall, a badly destroyed oven structure made out of stones and bricks, and part of the tight clay packing of a possible floor surface. The artefacts found date the building to the mid-16th century. The excavated section of the building lies directly on a surface of muddy clay, which is the prevailing natural subsoil in the area. The bottom of the excavated floor layer was situated on a level of 1.5 to 1.6 m a.s.l.<sup>4</sup> (Knuutinen et al. 2014). It seems unlikely that the building would have been situated in an area where periodically rising sea levels would have been a constant risk. The location suggests that the shore level during the 16th century was considerably lower than the calculated 1.5 m a.s.l., and closer to, or even lower, than the 1.0 m a.s.l. reported by Miettinen at Orslandet (2011: 81). In this case the results from Raseborg, together with Miettinen's results from Orslandet, differ considerably from observations made at medieval sites on the southwestern coast of Finland after the 1980s.

Archaeological observations from the medieval towns of Turku (Uotila 2006: 24–5) and Naantali (Hiekkanen 1988; Uotila 2003: 35–7) as well as the castle of Kuusisto (Paatonen 1994; Wahl-

berg 1994; Uotila 1998: 107–11; 2000: 299–300) indicate that at the beginning of the 16th century, shore displacement has stagnated and even reversed on the southwest coast of Finland. A similar phenomenon has also been reported at medieval sites on the eastern coast of Sweden (especially Ödman 1987; 1998: 21–2). The common consensus among researchers is that the phenomenon was caused by sea level transgression in the Baltic Sea, related to a rapid climatic change at the turn of the 15th and 16th century (more discussion on the subject e.g. in Uotila 1998: 79–82, 149–50). However, as Miettinen has pointed out, local anomalies in the isostatic land uplift may also cause variation in shore displacement on a local scale (Miettinen 2011: 82–4 and referred literature).

There are also other possible explanations for anomalous shore levels in the vicinity of the Raseborg Castle. As the archaeological data from excavations in 2008–2009 and 2014 have shown, large-scale construction works were carried out in the surroundings of the castle during the Middle Ages. The embankment in the Slottsmalmen area was perhaps only part of a larger set of works with which the watery landscape was controlled. Even though there is no archaeological evidence of damming or other structures built to control the water level around the castle, their existence cannot be overruled. For example, a wooden palisade around the castle, identified as a sailing blockade (Alopaus 1984), could slow down the natural water flow and increase sedimentation around the castle island as shown in the castle of Kuusisto (Alopaus 1994: 103). In the case of Raseborg, the effect on shore level would have been local, affecting perhaps only a very small area around the castle.

#### The implications of the model

Despite the fact that there still are many uncertainties concerning the shore displacement process in the Raseborg area, the model presented here can be used as a tool to examine the effect of the phenomenon on a number of activities related to the communications, land use and organisation of the surroundings of the castle. The model shows that at least until the beginning of the 15th century there

<sup>3</sup> Results from the 14C datings (HELA 3866–3869) will be published in more detail after the analysis of the material are complete.

<sup>4</sup> The heights are given here in the N2000 height system and therefore differ approximately +0.25 m from the ones given in the Finnish N60 system in the excavation report.

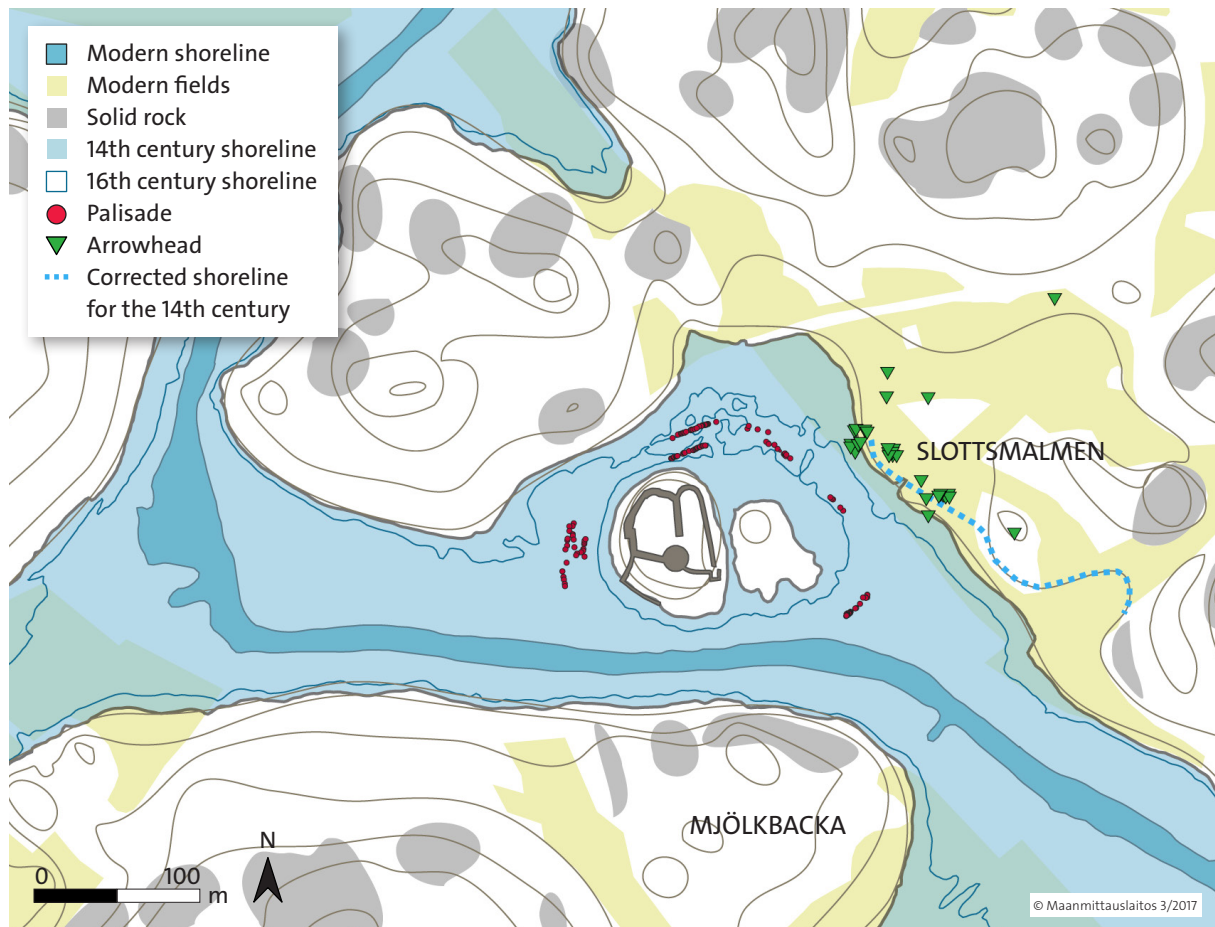


Figure 5. The shore level reconstruction from the 14th to the 16th century, together with the palisade, arrowheads and suggested corrections of the shore displacement model, based on the recent archaeological observations. Map: Tarja Knuutinen and Maija Holappa.

were two possible sailing routes to the castle: the southern route, which followed the lower reaches of the modern Raseborgsån River, and the north-western route, which approached the castle from the north. Unlike the previous models by Drake and Al-opaeus, the new model shows a narrowing of both routes from the 14th to the 16th century (Fig. 4). It seems that already during the 16th century the connection to the sea through the north-western route vanished, and the channel of the Raseborgsån River took its present-day form. This development is of importance as regards understanding the changes in the castle's landscape setting and connections to the sea.

Historical sources support the deterioration of the sailing routes presented in the model. In his letter to Nils Grabbe in 1525, King Gustav Vasa orders

the old Raseborg Castle to be replaced by a new one, built in Ekenäs, where it is easier to arrive by ship (FMU 6225). The same justification for building a new castle is also mentioned in a letter from the King in 1527 (FMU 6376). In the first map depicting the Raseborg area in 1682 (KA B1a 106–108; Fig. 7), the river channel seems to be fully formed and the inlet that formed the northern connection to the sea has narrowed into a small stream.

An interesting question for future research regarding the sailing connections at Raseborg will be how navigable the two routes were. Whereas the north-western route was wider and therefore possibly easier to navigate, as the model shows, its northern end was considerably shallower and therefore more vulnerable to changes in water level than the southern route. On the other hand, the lower reach-

es of the Raseborgså River underwent heavy dredging work in the 20th century, which has altered the form and depth of the channel. Therefore, it is difficult to decipher whether the route was accessible to larger vessels even in the 14th century. More detailed information on topography and archaeological remains on both routes will be needed.

Sailing connections were not the only thing affected by the shore displacement. The receding shoreline had its effect also on land use around the castle, changing defensive features, suitability of land for cultivation and husbandry, even possibilities for fishing and fowling. These questions are further discussed in the following chapters based on the shore displacement models as the foundation of the study.

## TOPOGRAPHY AND MILITARY MANOEUVRES

### Defending the castle

Even though the historical records related to the military activity at Raseborg are sparse, they show that there were constant efforts to maintain and improve the defences of the castle. The topographical and landscape setting of the castle, together with the evolution of warfare, including the adoption of firearms, strongly influenced the measures taken to update the castle's defences. In similar vein, possible attacks and sieges depended on the opportunities and barriers afforded by the landscape.

A high, rocky island surrounded by water is a typical place for a medieval castle, recommended in instructions considering castle building given in the Swedish *Konungastyrelsen*, the art of ruling, in the 1340s. This kind of location was considered perfect for preventing possible attackers from getting too close to the walls, where breaching was possible with several methods (see e. g. Contamine 1984: 102–6). On the other hand, the high rocky hills surrounding the Raseborg castle island made the location perhaps less favourable from a defensive point of view (Lovén 1996: 34, see also Uotila 1998: 155).

According to the current understanding, the first defensive structure on the island was the main

castle, with its towers. The eastern outer bailey, presumably designed to defend the main gate, was constructed in the 15th century at latest. The south-eastern and southern baileys were probably built during the last section of the same century (e. g. Drake 1991: 116–7, 133–5; Gardberg 1993: 85–9; Uotila 1998: 125–7). The defences also included an underwater wooden palisade circling the main castle and the island of Stallholmen (Fig. 5). The palisade has been dendrochronologically dated to the winter of 1426–1427 by Pentti Zetterberg, but the results represent only a small part of the structure (Lovén 1996: 159; Uotila 1998: 127). Similar structures have been found around other Finnish coastal castles, including the castles of Turku and Kastelholm as well as the bishop's castle in Kuusisto (Uotila 1998: 146–7).

The existence of an artificial moat surrounding the castle has been discussed by several scholars (e.g. Hartman 1896: 111; Alopaeus 1984: 85–6; Drake 1991: 120–1). At least during the 14th and the 15th century water created a natural hindrance around the castle island, and an artificial moat would not have been needed. However, following shore displacement, this natural moat gradually dried-up and became easier to traverse. It seems that by the beginning of the 16th century a narrow land connection existed between the castle island and the mainland on the northern side of the castle. At this point, an effort to improve the castle's defences by creating an artificial moat could have been made. The most probable place for such a work would have been on the northern side of the castle island, together with the narrow gap between the castle island and Stallholmen (Fig. 5.)

Firearms were adopted as part of the defences of Raseborg already in the 1430s (FMU III, no. 2102; FMU 2285) but it seems that there were few cannons initially, and most likely no permanent structures for artillery. The most typical places for cannons in medieval castles were the castle gates because of their vulnerability, but also the terraces of the towers were used (Contamine 1984: 202). In Raseborg, cannons located near the main gate or in the southeastern tower would have partly solved the problem of defending the castle against enemies approaching from the east or south, where the to-

pography of the castle island was less defensible. Evidence referring to the possible locations of cannons and shooters in the castle are scarce. Because of the heavy-handed restorations it is hard to say which embrasures in the walls are original, and consequently, the possible range of fire is difficult to decipher. Furthermore, possible structures located in Stallholmen would have affected the range of fire to the east.

Cannon balls, a large number of arrowheads and other military finds have been found within the castle walls. Many of these finds, especially the projectiles, are likely the remains of the castle armoury. Because of the lack of information on exact find contexts, it is difficult to interpret whether any were actually shot at the castle. A caltrop found in the castle (KM 5214: 2) could indicate the defenders of the castle preparing for a cavalry attack (Terävä 2015).

#### Attacking the castle

As pointed out earlier, there is not much information in the historical record about sieges and fights related to Raseborg. According to folklore, the stone walls of Raseborg were fired upon from the hill of Uvalaberget during a battle between the Swedes and Danes (Hartman 1896: 104; Wefvar 1879: 24). This could relate to the destruction of the castle in 1523 (Haggrén 2014a: 22). Uvalaberget is located about 1.5 kilometres away from the castle, and even though historical records imply that firearms with stronger loading could reach this distance already in the 14th century (Hedberg 1975: 58), the distance would have been too great to cause any harm (Fig. 4). Georg Haggrén (2014a: 22) assumes that the besieging force could have passed Uvalaberget and situated themselves upon Mjölckbacka, a rocky hill south of the castle, near enough to be a possible shooting place (Fig. 5).

Even if firearms proved to be a deciding factor on some occasions during the medieval period, there are also mentions in historical sources referring to their ineffectiveness on fortifications (Contamine 1984: 201; Jones 1999: 179–82). Any attempt to destroy massive stone walls was hard work, and required heavy bombards and close proximity to the

castle (Paulaharju 1992: 168; Uotila 2000: 297–8). Getting close enough to the fortification probably required a well-planned attack, assisted with soldiers equipped with other weapons, and perhaps even digging and building protective structures for the cannons (Contamine 1984: 201). Such operations would have modified the landscape around the castle, but so far no such remains have not been found at Raseborg.

According to folklore, large bombards would have been used to bring down the walls of the castle of Viipuri (Viborg in Swedish) in 1495 (Paulaharju 1992: 24). Otherwise historical sources do not refer to attacks on Finnish castles made with firearms before the 16th century. In the case of Finnish castles, Kari Uotila suggests that medieval cannons would not have been considered as a very significant threat, and these new weapons were not the primary cause for new constructions like the outer baileys that appeared from the late 14th century onwards (Uotila 1998: 154–5; 2000: 297–8).



Figure 6. Crossbow bolts from the excavations of Slottsmalmen. Photo: Anna Lehtinen/Konservointipalvelu Löytö.



Still, as Uotila points out (1998: fig. 99, p. 155), there are potential places to situate cannons within shooting range around Raseborg. Even though these places would have been useless for destroying the walls of the castle with cannons, the distance is short enough for using mortars as well as other missile weapons like trebuchets (Hedberg 1975: 10–13, 58; about missile weapons, see also Huldén 2004: 122–4; Paulaharju 1992: 7–10). Of course, the range of bows was also long enough from the 14th century onwards to send a hail of arrows the castle island (about ranges of medieval bows, see e. g. Lidén 1997: 190 and Kooi 1983: 196). On the other hand, one problem might have been that the attackers, situating themselves at these supposedly treeless hills surrounding the castle, were easily seen and thus fired upon before they could build any protective structures. Barring new defensive solutions, the retreating shoreline would also have increased the number of potential shooting places near the castle.

The transportation of missile weapons and larger cannons was a time- and energy-consuming ordeal unless sailable waterways were available (Jones 1999: 181). Because Raseborg was a coastal fort, it is easy to assume that the enemy arrived there by ship or boat, and the palisade around the castle suggests that preparations were made to prevent hostile vessels from getting too close to the main castle. Furthermore, the castle accounts from 1541 (KA 2921: 19, 21 and 22) and 1544 (KA 2937: 33, KA 2938: 54) suggest that some kind of archipelago ships were built beside the castle. These types of vessels are known to have been equipped with firearms on some occasions (Svensk Uppslagsbok 1955: 645) and perhaps could have been used against vessels attacking the castle. If the guarding of the itineraries in the Gulf of Finland was organized at Raseborg as it seems in some cases (e. g. KA 2934: 39), vessels capable of fighting at sea must have been at hand.

The navigability of the two possible sailing routes leading to Raseborg is still a question for future research, but it seems that at least by the 16th century the castle could no longer have been reached by larger vessels. The shallowing waterways would have forced ships to anchor further away from the castle, thus making it more cumbersome to attack

the castle but also to launch vessels to sea from the castle. On the other hand, vessels equipped with light artillery could have been simply rowboats with sails. Larger cannons on ships become more common during the 16th century (Hedberg 1975: 127–8). The effectiveness of the earliest cannons used on ships is unknown, but using them to destroy the walls of a castle located on a high hill was probably impossible. Ships were most likely used to blockade the waterways and convey soldiers and weapons, or to prevent people escaping or defending the castle. Ships may have also been used in assailing the ships belonging to the castle and thus played an active role in besieging.

The aim of attacking a castle was not necessarily to destroy but to gain control of it. This could be more effectively obtained by blockading the area, threatening, or giving the defenders a chance to surrender without suffering (Contamine 1984: 102; Lidén 1997: 189). At Raseborg the tactic of clemency seems to have worked at least in 1487 (FMU 4156; Hartman 1896: 54–6; Rask 1991: 67–8). Weaponry could also be used to threat and harass, for example by shooting at the castle without any real purpose of causing major damage.

The effectivity of medieval firearms was not based on the real destruction power of these weapons – instead it was long based on mystical assumptions about their power, and the fear of these weapons was boosted by their loud noise and smoke (Paulaharju 1992: 168). Thus the firearms could very well have been used mainly to terrorize the people inside the castle. After all, the adopting of firearms had very little effect on siege tactics in the Middle Ages (Jones 1999: 183). In Raseborg the local topography and deteriorating sailing connections probably affected the tactics of attackers more than the adopting of firearms. If the castle became more difficult to access for larger vessels, the attackers might have preferred infantry and cavalry to ships when approaching the castle.

The latest archaeological excavations in Slottsmalmen revealed quite many military finds. Most were arrowheads (Fig. 6.) and small lead bullets from handguns, but there were also some other pieces of weapon and armour among the find material. An interesting question is whether these muni-

tions, broken weapons and pieces of armour are the remains of everyday life,<sup>5</sup> or do they relate to conflict that took place at the castle?

The possibility of a battlefield at Slottsmalmen is deserving of further investigation in the future, since east was the most likely direction for attacking the castle by land, especially if cavalry were used. During a siege blocking the access between the castle and the main land was the easiest on the eastern side of the castle. That is why Slottsmalmen could be a possible place for a culminating battle.

## SUBSISTENCE AT THE COASTAL CASTLE

A considerable amount of animal bone was recovered during the excavations at Slottsmalmen in 2008 and 2009 (Table 1). The material consisted mostly of food, butchery and handicraft waste in a layer above the constructed embankment. This would imply that food waste in the form of bone material was seen as an important source of building and fill material for the castle. It is also an important source of information that can be used to trace how the castle inhabitants used the local landscape as a resource for obtaining animal produce for food.

Food resources could be locally and regionally provisioned or secured from more distant locations, for example via trade. The landed estate and the castle surroundings would have been part of the local food production, as would the peasant farmers close to the castle. Regionally provided meat products or domestic animals could be brought to the castle from a longer distance, likewise fish, birds and other wild animals. Some taxed foodstuffs would preserve for quite a long time and could be

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<sup>5</sup> For example, practicing by using weapons in games and competitions is a very well-known activity from medieval times (f. ex. Olaus Magnus 2002 [1539, 1555, 1567]: 92) and at Slottsmalmen there has been found one arrowhead (KM 2008063: 35) which could be a part of a training arrow (Terävä 2015: 118, fig. 11). Weapons have also been used in hunting and as a part of everyday dress, so normal life might relate to pieces of weapons ending up in places where people have spent their time.

transported from more distant locations and used in trade.

## The landed estate and the domestic animals

The landed estate and the occupants of the castle secured access to foodstuffs in various ways. The foodstuffs for the castle kitchen were partly provided by the castle estate and partly by taxed goods and foodstuffs traded and brought to the castle. The basis of food production in Raseborg was agriculture, husbandry and the meat provided by domesticated animals. Cattle, pigs, sheep, geese and chickens are mentioned in the castle accounts every year. Goats have been identified in the osteological material but they are not mentioned in the account books. Vegetable products included in the account books include cereals, hops, peas and beans. This part of the article will concentrate on the animal produce and how it reflects and is used in the castle landscape.

The domestic animals were kept in the landed estate and they would have been fed with resources grown in the castle fields. The receding wetlands would open up meadows for grazing animals, which were needed for their meat, but also for the milk they produced, which would be turned into better preserving butter and cheese. Among the foodstuffs consumed in the castle during the 16th century were meat from cattle, sheep and pig, cattle tongues, sausages and offal (e.g. KA 2921: 12–3, 22; KA 2979: 48–51; KA 2989: 68–70). Preserved meat could also be shipped to the castle from Stockholm, to be distributed wider to the realm (KA 2979: 33–5; KA 2989: 46–8).

The castle fields, seen in figure 9, would need to be ploughed in preparation for cereals and other crops. Horses could be used for the task but also oxen, which are mentioned in the account books (e.g. KA 2921: 21; KA 2925: 2). Evidence of draught oxen can also be seen in the osteological material in the arthritic lower limb bones (femur, tarsal and metatarsal bones) of cattle. The weight of the plough tends to accumulate to the lower limbs in the ploughing action which can cause wear on the joints causing arthritis (Bartosiewicz et al. 1993: 71). Thus, oxen were used as draught animals in ploughing the fields.

### Fish as a taxed, traded and locally caught resource

When looking at the 1682 map of the castle (KA MHA B1A 106-108; Fig. 7) and the shore level reconstructions (Fig. 4) presented in this article, the potential hunting and fishing grounds stand out. An effort to match these surroundings with animal species found in the osteological material at Slottsmalmen and the castle accounts can give new information on how the castle environment was utilised. The inlet leading to the castle was shallow and quite wide already during the Middle Ages. This would be an ideal environment for carp fish, pike, perch, zander, eel and burbot. These fish species would also thrive later on, when the water level declined.

Fish can be seen in the castle accounts in the form of processed foodstuffs, such as dried or salted fish. Carp fishes, such as ide, roach and common bream, were obtained from the castle fishery, together with herring (e.g. KA 2921:17–19; KA 2989:18–19). Carp fishes and herring have different living environments, which indicates either that there were at least two fisheries which were referred to as one, or that the fishery was a larger area including shallow and deeper waters. Herring and carp fishes also occur in the account books as taxed foodstuffs (e.g. KA 2918; KA 2989:30–1). In other words, they were caught by fishermen employed by the castle, and taken in as part of the peasant tax payment to the crown. The cyprinids seem mostly to have been caught and consumed at the castle (KA 2979:34–6; KA 2989:48–9).

There are several fish species in the osteological material which are not mentioned in the account books. The fish species found in the osteological material were in general from three different environments: shallow waters, coasts and open sea. The shallow water species have already been discussed. In the coastal areas one could catch pike, perch, ruffe and burbot. Herring, salmon, eel, cod, common whitefish and sturgeon were caught in brackish water. The change in water levels in the coastal areas would probably push some fish species a bit further away from the vicinity of the castle, but it would not represent a significant change for the shallow water species. Sturgeon was identified by only a few frag-

TAXON	NISP
Cattle <i>Bos taurus</i>	3588
Sheep <i>Ovis aries</i>	164
Goat <i>Capra hircus</i>	14
Sheep/Goat <i>Ovis/Capra</i>	2434
Pig <i>Sus domesticus</i>	1028
Chicken <i>Gallus domesticus</i>	231
Geese <i>Anser</i> sp.	69
Pike <i>Esox lucius</i>	1210
Cod <i>Gadus morhua</i>	347
Burbot <i>Lota lota</i>	1
Perch <i>Perca fluviatilis</i>	3103
Zander <i>Sander lucioperca</i>	41
Ide <i>Leuciscus idus</i>	31
Roach <i>Rutilus rutilus</i>	61
Tench <i>Tinca tinca</i>	2
Carpfish <i>Cyprinidae</i>	3188
Eel <i>Anguilla anguilla</i>	1
Whitefish <i>Coregonus lavaretus</i>	10
Herring <i>Clupea</i> sp.	7
Sturgeon <i>Acipenser sturio</i>	2
Western capercallie <i>Tetrao urogallus</i>	8
Black grouse <i>Tetrao tetrix</i>	1
Hazel grouse <i>Bonasa bonasia</i>	33
Mallard <i>Anas platyrhynchos</i>	3
Common eider <i>Somateria mollissima</i>	18
Greater scaup <i>Aythya marila</i>	1
Long-tailed duck <i>Clangula hyemalis</i>	18
Gooseander <i>Mergus merganser</i>	5
Red fox <i>Vulpes vulpes</i>	4
Mountain hare <i>Lepus timidus</i>	197
Squirrel <i>Sciurus vulgaris</i>	26

Table 1. The number of identified specimens in bone material from Slottsmalmen

ments and could be thought of as import. The same applies for salmon, which was identified by bones from the vertebra.

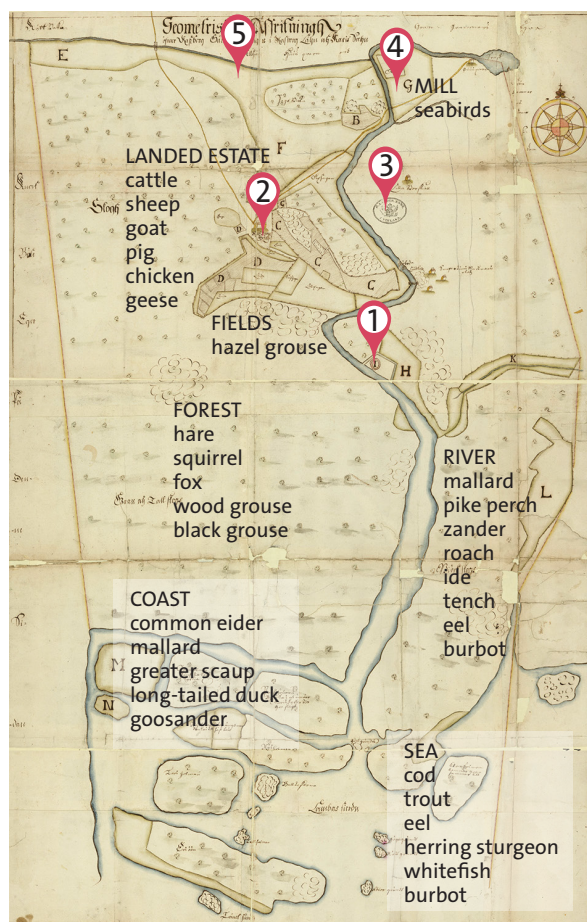


Figure 7. A map from 1682 by Lars Forsell with potential areas for different food resources. 1 – Raseborg castle, 2 – Raseborg manor, 3 – Snappertuna, 4 – Huskvarn, the castle mill, 5 – North-western inlet.

The castle employed some fishermen and owned fishing nets for perch, carp fishes and herring. Nets for summer and winter use are included in the account books (e.g. KA 2918; KA 2924; KA 2929; KA 2933; KA 2944; KA 2946). If all these fishes were obtained from the castle fishery, this would mean that one of the castle fisheries could be located in the inlet surrounding the castle, and the other along the coast line and probably closer to the outer archipelago where herring, eel and common whitefish could be fished. During the winter fish could be obtained by nets set under the ice.

The peasants could also fish in the castle fisheries for a fee, which was typically paid as salted fish,

for example herring, which could be salted with salt provided by the castle (e.g. KA 2979:9–10; KA 2989:18). Also tenant farmers and fishermen from Långö, Nothamn and Svartkam (see Figs. 4–6) in the archipelago could pay their taxes in fish and fish products (Haggrén 2013:54), likely caught in the outer archipelago and the Baltic Sea.

The anatomical distribution and cut marks on the cod bones suggest that the fish were brought to the castle salted and/or dried. The fish were probably taxed goods or related to trade, which is supported by the castle accounts where cod occurs only as a salted product. The size of the vertebra implies that the fish were caught in the Baltic Sea.

### Local and regional resources

The inlet would also be a good place to catch birds. Seabirds are mentioned in the account books from 1540 and 1550 as part of the food inventory (KA 2918; KA 2979:35, 49). They were also described to be caught at the castle mill in the accounts from 1540 (KA 2918:59, see Figs. 4–6 and 8). Specific species of seabirds are not mentioned in the account books. The species found in the osteological analysis were common eider, greater scaup, goosander, long-tailed duck and mallard. Mallards and goosanders can still be seen in the castle area all year around. The other species prefer coastal environments, and at least the long-tailed ducks and greater scaups were probably caught during the migration period (Staav & Fransson 2007: 99–100, 109–10, 114, 122–3). This would also indicate that the birds were caught near the inlet or in the adjacent archipelago/islands.

In addition to seabirds, grouse were identified in the osteological material. These birds are absent from the historical sources. The receding shoreline exposed new fields and woodland meadows around the castle and would have afforded the hunting of hazel grouse and probably also black grouse (see Figs. 4–6 and 8). Wood grouse on the other hand prefer old, sparse pine forests (Staav & Fransson 2007: 174, 177–8). All these birds could be locally caught in the castle area, but also transported dried or salted from a longer distance. The same applies to seabirds.



Another animal which could be caught locally was elk, which was served at the bailiff's table in 1550 (KA 2979:34, 49). Elks are not conspicuously present in the account books and were probably a luxury food item even for the bailiffs. No elk bones have been identified in the osteological material. Other wild mammals found in the osteological material were fox, squirrel and hare. Fox and squirrel were typical animals caught for the fur trade. Hare could be used as food and for its fur, and can be found in almost any environment. Squirrels, foxes and elk prefer forests for their habitat and the presence of these bones in the assemblage may suggest that there were sufficient forest areas nearby to provide game.

## CONCLUSIONS

According to the present understanding, Raseborg was originally established as a coastal castle in the latter half of the 1370s. However, during the following 200 years the castle's locale underwent a major environmental and landscape change due to shore displacement. The process of the shore displacement has been well recognised in the research of the site, but its effect on the activities at the castle has not been thoroughly studied. Moreover, previous models of the shore displacement at Raseborg have been on a very rough scale or based on very simplistic calculations. Therefore, detailed study of the subject is needed.

Recent archaeological excavations together with fresh results of shore displacement studies on the western Uusimaa region offer new data, enabling the creation of a more precise model of the medieval shoreline around the Castle of Raseborg. The results presented in this article suggest that the shore displacement in the Raseborg area followed neither the previously presumed linear shore displacement rate nor the fluctuations observed at several other medieval sites on the southwest coast of Finland and eastern coast of Sweden.

The archaeological data collected from the Slottsmalmen area together with the preliminary results of <sup>14</sup>C datings from the earliest cultural layers on the eastern shoreline zone show that in the 14th

century the water level of the small inlet was approximately 2.5 meters a.s.l. instead of the height of 2.1 m a.s.l. suggested by the calculations based on the linear shore displacement rate. Observations made during the excavations in 2014 suggest that in the 16th century the shore level in the nearest vicinity of the castle was closer to 1.0 m a.s.l. than the expected 1.5 m a.s.l. This interpretation is supported by historical documents referring to the deteriorating sailing connections to the castle.

In Raseborg, the human impact on the local topographical conditions grew from the 14th century onwards. Since there is evidence of heavy construction work to control the littoral landscape of the castle area during the Middle Ages, the human impact on the anomalously low shore level in the 16th century may be considerable. However, similar observations of low shore levels in the 16th century have been made at Orslandet, located only 15 kilometres east from Raseborg. This indicates the possibility of a regional geological anomaly in the rate of shore displacement.

Besides accessibility, the defensive capabilities of the castle were also affected by the shore displacement. In the 15th century the castle island was still surrounded by water, which created a natural barrier. The palisade encircling the castle, interpreted as a sailing blockade, belongs to this phase. After the turn of the 16th century this natural defensive feature was gradually disappearing because of the receding shore line. The existence of an artificial moat around the castle has long been discussed, but clear archaeological or historical evidence is still lacking. However, the need for such a construction could have emerged during the latter part of the 15th or beginning of the 16th century.

The analysis of the surroundings of the castle can also be used to assess the possible ways of attacking the castle. The hilly terrain made it possible to fire upon the castle from higher grounds, but the topographical conditions would not have been particularly favourable for transporting heavy weapons by land. Bringing weapons near the castle in ships or boats would have been fairly effortless and the palisade can be seen as a response to this kind of threat. Of course as the landscape changed, attack by land might have become easier compared

to an assault made from the sea. The most probable way to approach the castle using infantry and cavalry would have been from the east, through the Slottsmalmen area. Considering the interplay between shore displacement and defensive or offensive solutions in and around the castle, the actual navigability of the water routes will be an essential theme for future research.

Another issue affecting the possible defensive solutions of the castle was the increasing use of firearms during the 15th century. It is known that there were cannons at Raseborg already in the 1430s. Firearms were used in military campaigns that took place at Raseborg during the 1520s, but the extent of their use is unknown. In order to cause any real damage, cannons needed to be either located very near the castle walls or be very powerful, and, as a consequence, physically larger. Using cannons in this way would have required quite massive operations, including protective structures built by besiegers. One interesting question is the actual need and will to invest in defensive or offensive works during the history of Raseborg. All in all, it seems that the castle was actually threatened only on a few occasions, and the military importance of the castle is not yet fully understood.

Understanding the local shore displacement and history of the water systems also contributes to the study of the castle's subsistence strategies. The littoral landscape offered a possibility for local fishing and fowling. The osteological analysis of the food waste found at the castle site together with close analysis of the castle accounts indicates that the local resources represented an important factor in food consumption at Raseborg. The accounts show that fowling took place at least in the vicinity of the castle mill but the osteological material suggests a wider area for obtaining birds.

In addition, the castle fishery and some of the species obtained from it are mentioned in the accounts, although the location of the fishery is still unknown. In fact, the species caught at the fishery prefer different living environments, which suggests that the castle accounts refer not only to one but to multiple fisheries belonging to the castle. Besides helping to locate potential places for castle fisheries,

the shore displacement reconstruction allows the study of the development of environments suitable for husbandry and cultivation. The wetland revealed by the receding water would have first been an ideal ground for meadows used for husbandry and later, as the land dried out, for cultivation.

The research carried out at Raseborg since 2008 has resulted in the use of materials and methods neglected in the previous research. These include osteology and artefact studies together with environmental and landscape archaeologies. They have allowed an insight into the yet unexplored parts of the castle's history. The material collected during the three field seasons has altered the picture of medieval Raseborg in many aspects, as the image of a complex medieval community related to the castle has started to emerge. At the same time, our understanding of the spatial organisation of the surrounding areas has greatly increased, revealing new information on the interplay between the local environment and the medieval castle.

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## REFERENCES

### Archival sources

*The National archives of Finland*

*Accounts of Uusimaa, Castle accounts from 1540–1559:* KA 2918, KA 2921, KA 2924, KA 2925, KA 2929, KA 2933, KA 2937, KA 2938, KA 2944, KA 2946, KA 2979, KA 2989

*Cadastral maps of Finnish National Survey*

Broterus, Samuel 1695. Alhof; karta öfver en del egor med beskrifning. KA MMA B15:1/1.

Forsell, Lars 1682. Geometrisk affritningh öfver Raseborg häradh Belägen i Raseborgs Lähn och Karis Sochn. KA MHA B1A 106-108.

*Archives of the National Board of Antiquities in Finland*

Jussila, T. & Seger, T. 1991. Raaseporin linnan ympäristön prospektointi ja fosforikartoitus. Unpublished research report.

Knuutinen, T., & Haggrén, G., Heinonen, T., Kivikero, H. & Terävä, E. 2008. Raasepori Slottsmalmen 2008. Unpublished research report.

Knuutinen, T., Haggrén, G., Heinonen, T., Kivikero, H., Kunnas, O., Terävä, E. & Åkerblom, R. 2009. Raasepori Slottsmalmen 2009. Unpublished Research report.

Knuutinen, T., Haggrén, G., Holappa, M. & Terävä, E. 2014. Raasepori Slottsmalmen. Kaivauskertomus 2014. Unpublished Research report.

## Literature

Alopaus, H. 1984. Raaseporin linnan uloimmat puolustusvarustukset sekä muita viimeaikaisia huomioita vastaavanlaisista paalutuksista. In Brusila, H., Drake, K. & Mikola, E. (eds.) 1984. *Historiallisen ajan arkeologia Suomessa*: 84–9. Turun maakuntamuseo, Turku.

Alopaus, H. 1994. Kuusiston linnan vesivarustukset. In Suna, A. (ed.) 1983. Kuusiston linna. Tutkimuksia 1985–1993. *Museoviraston rakennushistorian osaston raportteja* 8: 100–5. Museovirasto, Helsinki.

Ambrosiani, B. 1981. Changing water-levels and settlement in the Mälar district since AD 700. In Königson, L.-K. & Paabo, K. (eds.). *Florilegium Florinis Dedicatum. Striae Vol.* 14: 140–3.

Armitage, P.L. 1989a. The use of animal bones as building material in post-medieval Britain. *BAR British Series* 199: 147–60.

Armitage, P.L. 1989b. Gazetteer of sites with animal bones used as building material. *BAR British Series* 199: 201–23.

Bartosiewicz, L., van Neer, W. & Lentacker, A. 1993. Metapodial asymmetry in draft cattle. *International Journal of Osteoarchaeology* 3: 67–75.

Contamine, P. 1984. *War in the Middle Ages*. Trans. By Michael Jones. Oxford.

Drake, K. 1983. Raseborg som forskningsobjekt. *Karhunhammas*: 113–8. Turun yliopisto, Turku.

Drake, K. 1988. Runda tornet i Raseborg. In Korkeakoski-Väisänen, K., Lähdesmäki, U., Nissinaho, A., Pihlman, S. & Tuovinen, T. 1988. *Baskerilinja. Unto Salo 60 vuotta*: 121–9. Turun yliopistosäätiö, Turku.

Drake, K. 1991. Raseborg - gråstenmurarna berättar sin historia. In Rask, H. 1991. *Snappertuna - en kustbygds*

*hävder, del I*: 87–140. Ekenäs Tryckeri Aktiebolag, Ekenäs.

Ekman, M. 1996. A consistent map of the postglacial uplift of Fennoscandia. *Terra Nova* 8 (1996): 158–65.

Eronen, M., Glückert, G., Hatakka, L., Van de Plassche, O., Van der Plicht, J. & Rantala, P. 2001. Rates of Holocene Isostatic uplift and relative sea-level lowering of the Baltic in SW Finland based on studies of isolation contacts. *Boreas*, Vol. 30: 17–30.

Finnish Meteorological Institute. Vedenkorkeusennätykset Suomen rannikolla. <http://ilmatieteenlaitos.fi/vedenkorkeusennatukset-suomen-rannikolla>. Read 7.1.2015.

FMU III 1921, nro 2102. *Finlands Medeltidsurkunder III*. Utg. av Rein. Hausen. Helsingfors.

FMU 4156. Digitated from: Hausen, Reinhold 1910–1935: *Finlands medeltidsurkunder I–VIII*. Helsingfors. Diplomatarium Fennicum-database. <<http://extranet.narc.fi/DF>> Read 11–24.3.2011.

FMU 6225. Digitated from: Hausen, Reinhold 1910–1935: *Finlands medeltidsurkunder I–VIII*. Helsingfors. Diplomatarium Fennicum-database. <http://extranet.narc.fi/DF>. Read 15.12.2014

FMU 6376. Digitated from: Hausen, Reinhold 1910–1935: *Finlands medeltidsurkunder I–VIII*. Helsingfors. Diplomatarium Fennicum-database. <http://extranet.narc.fi/DF>. Read 15.12.2014.

Gardberg, C.J. 1993. *Suomen keskiaikaiset linnat*. Keuruu.

GFR XVII, 1896. *Konung Gustaf Den Förstes Registratur med understöd af stadsmedel I tryck utgifvet af Kongl. Rikssarkivet genom Victor Granlund. XVII 1545*. Stockholm.

Glückert, G. 1976. Post-Glacial shore-level displacement of the Baltic in SW Finland. *Annales Academiae Fennicae Scientiarum Fennicae A III* 118.

Haggrén, G., Holappa, M., Jansson, H. & Knuutinen, T. 2009. Alla tiders Raseborg – Kaikkien aikojen Raseborg 2008–2009. *SKAS* 4/2009: 36–45.

Haggrén, G. & Jansson, H. 2012. Raseborg through the ages. In Uotila, K. & Mikkola, T. & Vilkkuna A-M. (eds.) 2012. Castella Maris Baltici X. *Archaeologica Medii Aevi Finlandiae XVIII*: 61–70. Suomen keskiajan arkeologian seura, Turku.

Haggrén 2013. A medieval landscape of power and interaction: The castle of Raseborg and the peasants of the castle province. *SKAS* 1-2/2013: 48–60.

Haggrén, G. 2014a. Kun linnan olutkellari sortui... Raaseporin onnettomuus Anno Domini 1558. *SKAS* 4/2013: 14–36.

- Haggrén, G. 2014b. Raaseporin linnan tutkimukset kesällä 2014. *SKAS* 1/2014: 47–50.
- Hartman, T. 1896. Raseborgs slotts historia. *Skrifter utgivna av svenska litteratursällskapet i Finland*. Svenska litteratursällskapet i Finland, Helsingfors.
- Hedberg, J. 1975. *Kungl. Artilleriet. Medeltid och äldre vasatid*. Östersund.
- Hiekkanen, M. 1988. *Keskiajan kaupungit 4. Naantali*. Museovirasto, Helsinki.
- Huldén, L. 2004. Piirityskoneet. *Itänaajan vartijat 1. Keskiaika*: 122–4. Schildts, Helsinki.
- Jones, R. 1999. Fortifications and Sieges in Western Europe c. 800-1450. In Keen, M. (ed.) *Medieval Warfare. A History*: 163–85. Oxford University Press, Oxford.
- Jones, R. 2011. Elemental theory in evidence practice: food disposal in the later medieval English countryside. Klápste, J. and Sommer, P. (eds). *Processing, storage, distribution of food. Food in the Medieval Rural Environment. Ruralia VIII*. Brepols Publishers, Turnhout, Belgium.
- Knuutinen, T. 2010. Varhaisten tutkimus- ja restaurointitoimen vaikutus Raaseporin linnan lähiympäristön topografiaan ja maisemaan. *SKAS* 3/2010: 15–25.
- Knuutinen, T. 2012. Überlegungen zur Rekonstruktion von Umgebung und Infrastruktur der Spätmittelalterlichen Burg Raseborg. *Burgen und Schlösser: Zeitschrift für Burgenforschung und Denkmalpflege* 3/2012: 163–8.
- Knuutinen, T. 2014. Raaseporin Slottsmalmenin tutkimukset kesällä 2014. *SKAS* 1/2014: 42–6.
- Kooi, B. W. 1983. *On the Mechanics of the Bow and Arrow*. Proefschrift. Groningen.
- Kääriäinen, E. 1963. Land uplift in Finland computed by the aid of precise levellings. *Fennia* 89, No 1.
- Lovén, C. 1996. *Borgar och befästningar I det medeltida Sverige*. Kungl. Vitterhets-, historie- och antikvitetsakademiens handlingar, Antikvariska serien. Kungl. Vitterhets-, historie- och antikvitetsakademien, Stockholm.
- Lidén, H. A. 1997. On Weapons and Warfare. *Margarete I Regent of the North, Essays and Catalogue 1997*: 188–91. Grönder-Hansen, P. (ed.) Nationalmuseum & Nordiska Ministerrådet, Copenhagen.
- Miettinen, A. 2011. Shore Displacement in Western Uusimaa 500 BC – AD 1500. In Lavento, M. (ed.) 2011. Maritime Landscape in Change – Archaeological, Historical, Palaeoecological and Geological Studies on Western Uusimaa. *Iskos* 19: 61–86. Suomen muinaismuistoyhdistys.
- Nationel Arkivdatabas, Svensk Diplomatariums huvudkartotek över medeltidsbreven (SDHK). 11301/RA 0101. Charter signed by Tord Bonde in 8.9.1378. <http://sok.riksarkivet.se/SDHK>
- Olaus Magnus, Gothus 2002 [1539, 1555, 1567]. *Suomalaiset Pohjoisten kansojen historiassa, osa 1*. Jyväskylä.
- Paatonen, E. 1994. Maaperä B-tornin alueella ja tornin epätasainen painuminen. In Suna, A. (ed.) 1983. Kuusiston linna. Tutkimuksia 1985–1993. *Museoviraston rakennushistorian osaston raportteja* 8: 48–65. Museovirasto, Helsinki.
- Paulaharju, J. 1992. *Vanhat tykit – Rautaruukusta Helvigiin*. Sotamuseo, Helsinki.
- Pässe, T. & Andersson, L. 2005. Shore-level displacement in Fennoscandia calculated from empirical data. *GFF* 127:4: 253–68.
- Rask, H. 1991. Snappertuna - en kustbygds hävder. Ekenäs: Ekenäs tryckeri aktiebolag.
- Schjerfbeck, M. 1891. Raseborg. *Turistföreningens i Finland Årsbok*.
- Ståav, R. & Fransson, T. 2007. *Nordens fåglar*. Narayana Press, Danmark.
- Svensk Uppslagsbok 1955. Andra omarbetade och utvidgade upplågan. Band 32. Västgöter-ÖÄ. Äsping. Förlagshuset Norden, Malmö. 645.
- Tavastsjerna, W. 1905. Suomen maasotaväki Kustaa Vaasan ja Eerikki XIV:n aikana. *Historiallinen Arkisto* XIX: 121–77.
- Terävä, E. 2015. Armed life in Medieval Raseborg. Historical sources and Archaeological Finds related to Weapons and Armory in and Around the Castle. *Finskt Museum 2015*: 105–130. Helsingfors.
- Uotila, K. 1998. Medieval Outer Baileys in Finland. With Special Reference to Turku Castle. *Archaeologia Medii Aevi Finlandiae* III. Suomen keskiajan arkeologian seura, Turku.
- Uotila, K. 2000. The collapse of defence in Finnish castles around 1500. In *Château Gaillard XIX. Études de castellologie médiévale. Actes du colloque international de Graz (Autriche) 22.–29. Août 1998*: 297–303.
- Uotila, K. 2003. Naantalinnin kaupungin vaiheita vuosina 1443–1648. In Uotila, K. & Lehtonen, H. & Tulkki, C. (eds.) 2003. *Vallis Gratiae 1443–1648 – Arkeologisia tutkimuksia Naantalissa/Arkeologiska undersökningar i Nådendal*: 35–45. Kåkenhus-kirjat nro 1. Turku.
- Uotila, K. 2006. Aboa Vetustis-museon kivirakennusten tutkimukset v. 2002–2006. *SKAS* 2/2007: 18–27.
- Wahlberg, J.-E. 1994. Kuusiston linnansaaren kehitys keskiajalla. In Suna, Antti (ed.) 1994. Kuusiston linna.



- Tutkimuksia 1985–1993. *Museoviraston rakennushistorian osaston raportteja* 8: 66–78. Museovirasto, Helsinki.
- Wefvar, J. E. 1879. *Berättelse öfver Finlands Fornlemnningar utgifna av Finska Fornminnesföreningen*. IV. *Raseborgs Västra Härad*. Öfvertryck ur Finska Fornminnesföreningens Tidskrift IV: 1–119. Suomen muinaismuistoyhdistys, Helsinki.
- Vestøl, O. 2006. Determination of postglacial land uplift in Fennoscandia from levelling, tide-gauges and continuous GPS stations using least squares collocation. *Journal of Geodesy* 80 (2006): 248–58.
- Young, A. 1804. *General view of the agriculture of Hertfordshire*. Newton Abbot, David & Charles.
- Åse L.-E. 1969. Arkeologiska vittnesbörd om strandförskjutningen vid Stockholm under de senaste c. 4000 åren. *Geologiska föreningen i Stockholm Förhandlingar*, 91:4: 536–60.
- Åse, L.-E. 1970. Kvartärbiologiska vittnesbörd om strandförskjutningen vid Stockholm under de senaste c. 4000 åren. *Geologiska föreningen i Stockholm Förhandlingar*, 92:1: 49–78.
- Ödman, A. 1987. Stockholms tre borgar. Från vikingatida spärrfäste till medeltida kastellborg. *Monografier utgivna av Stockholms stad* 80. Kommittén för Stockholmsforskning, Stockholm.
- Ödman, A. 1998. Öresundsområdet som medeltida krigsskådeplats. Strandförskjutningen och Saxo Grammaticus. In Engström, J. & Frantzen, O.L. 1998. *Öresunds strategiske rolle i ett historisk perspektiv. Dansk-Svensk symposium 3–7 juni 1996*: 21–34. Armémuseum, Stockholm.